

Occupational Factors in Lung Cancer

—A Preliminary Report—

By LESTER BRESLOW, M.D.

ONE OF THE MOST striking disease phenomena of the past two decades is the sharp increase in deaths due to lung cancer. The age-adjusted mortality rate for lung cancer in the United States climbed from 2.7 per 100,000 population in 1930 to 11.0 in 1948, a more than fourfold increase.

This higher rate is not a mere statistical artifact due to improved recognition of the disease. The lung cancer rate has increased two and a half times more rapidly among men than among women. It is highly unlikely that diagnostic improvements have been applied two and a half times more completely to men than to women. Furthermore, the increasing proportion of lung cancer found as a cause of death among autopsies in hospitals also attests to a real increase in this disease (1).

Lung cancer has become largely a disease of men. The age-adjusted mortality rate among males in the United States in 1948 was 17.5 per 100,000 population, nearly four times as high as the female rate of 4.6. Among males aged 45 to 64 years, lung cancer caused 3.1 percent of all deaths that year (2). If present trends continue, it will soon exceed tuberculosis as a cause of death among males in the United States.

Dr. Breslow is chief of the bureau of chronic diseases, California State Department of Public Health. He recently served as director of study for the President's Commission on the Health Needs of the Nation.

It is reasonable to assume that some change or changes in the environment account for this phenomenon. In such a hypothesis it is necessary to take into account the fact that our knowledge of carcinogenesis in man indicates a long latent period. Hence, an increase in the lung cancer mortality rate during 1930-48 may reflect environmental changes during the period 1900-40.

Evidence has already been accumulated which indicates an association between lung cancer and excessive cigarette smoking (3-6). Certain occupations, especially those involving exposure to chromate ore (7) and radioactive minerals (8), have also been implicated in the causation of lung cancer. However, the number of persons with such occupational exposures in the United States is relatively small.

Collection of Data

In an effort to get further data on the etiology of lung cancer, the California State Department of Public Health has investigated the occupational and smoking history of a group of lung cancer patients and of a control group.

The first group was composed of persons with histopathologically proven lung cancer in nine California hospitals. For every cancer patient, a patient of the same age, sex, and race admitted to the same hospital at about the same time for any condition other than chest disease or cancer was admitted to the control group. Thus, the lung cancer series and the control series were equated as to age, sex, and race. They were

Table 1. Number of patients with 5 or more years' exposure in randomly selected occupations among 408 lung cancer cases and 408 controls

Occupation	Lung cancer cases	Controls
Total.....	98	88
Hotel and restaurant managers....	5	5
Bookkeepers and cashiers, except bank cashiers.....	5	2
Salesmen, real estate.....	4	7
Bartenders.....	5	7
Guards and watchmen, except crossing watchmen.....	9	15
Animal and livestock farmers.....	4	5
Gardeners and grounds keepers....	6	11
Electricians, skilled.....	6	6
Brakemen, railroad, skilled.....	9	3
Drillers, extraction of minerals and construction, skilled.....	6	2
Route men, semiskilled.....	9	8
Construction occupations, unskilled.....	30	17

also roughly equated as to socioeconomic status since both groups contained the same proportion of patients admitted to county-indigent, Federal, teaching, and private hospitals.

Each patient was questioned about the type and amount of his smoking and was asked for a detailed occupational history. The scope of the occupational data is indicated by the fact that each interview covered the patient's life-long history, required from 1 to 3 hours, and was conducted by a qualified occupational analyst.

Analysis of Data

Preliminary analysis of the data for 408 lung cancer cases and 408 controls confirms the association between excessive cigarette smoking in lung cancer identified in previous studies.

Preliminary analysis of the data implicates several occupational exposures not previously identified. A total of 59 occupations were listed five or more times by either cases or controls, or both, with a history of at least 5 years' exposure. The 12 occupations listed in table 1 are a random selection from these 59.

The five occupations listed in table 2 were selected by the observations, first, that the number of lung cancer cases exceeded by several times the number of control cases, and second,

that a common exposure among the five occupations appeared to be certain metal fumes and particles. The welders were arc and acetylene welders. The cranemen and derrickmen specified in their histories that they had worked on operations involving molten metals with consequent exposure to accumulated metal fumes. The majority of the firemen had worked in connection with either ships' boilers or industrial boilers. Although there were approximately equal numbers of miners with exposure to only gold and silver in both the group of cancer cases and the control group, the number of miners exposed to copper, lead, or zinc mining in the lung cancer group exceeded the number in the control group, indicating some association of this occupation with lung cancer. Likewise, tool dressers and drillers in oil-drilling operations appear more frequently in the series of cancer cases.

Although the numbers involved for the individual occupational groups are small, tests of significance showed that for cranemen and derrickmen exposed to metals the differences observed between cases and controls would be unlikely to occur by chance ($p < .05$) in repeated samples from the same population; for firemen (marine and stationary boilers) the observed differences also would be unlikely to occur by chance ($p < .01$).

Differences observed for welders, metal miners (copper, zinc, and lead), and tool dressers and drillers could occur by chance more frequently than the generally accepted level of statistical significance ($p > .05$).

Table 2. Number of patients with 5 or more years' exposure in selected occupations among 408 lung cancer cases and 408 controls

Occupation	Lung cancer cases	Controls
Total.....	40	8
Welders.....	8	2
Cranemen and derrickmen, exposed to metals.....	5	0
Firemen, stationary and marine boilers.....	11	1
Metal miners, copper, lead, and zinc.....	9	3
Drillers and tool dressers, oil.....	7	2

It is extremely unlikely that the observed difference for the total group would occur by chance ($p < .0001$); hence it is deemed to be significant.

Conclusion

This exploratory study was intended merely to identify occupations that have a suggestive association with lung cancer. The five occupations shown in table 2 are of this character. These occupations and the individuals so employed should be studied intensively in order to determine the exact nature of the relationship to lung cancer.

Suggestive differences have also been noted in this preliminary analysis with respect to other occupations; these likewise deserve further study.

REFERENCES

(1) Hueper, W. C.: Occupational tumors and allied

diseases. Springfield, Ill., and Baltimore, Md., C. C. Thomas, 1942, 896 pp.

- (2) U. S. National Office of Vital Statistics: Vital statistics of the United States, 1948. Part I. Washington, D. C., U. S. Government Printing Office, 1950, table 8.
- (3) Breslow, L.: Does cigarette smoking cause lung cancer? *California's Health* 9: 1-3 (1950).
- (4) Doll, R., and Hill, A. B.: Smoking and carcinoma of the lung. Preliminary report. *Brit. Med. J.* 2: 739-748 (1950).
- (5) Levin, M. L., Goldstein, H., and Gerhardt, P. R.: Cancer and tobacco smoking. A preliminary report. *J. A. M. A.* 143: 336-338 (1950).
- (6) Wynder, E. L., and Graham, E. A.: Tobacco smoking as possible etiologic factor in bronchiogenic carcinoma. A study of 664 proved cases. *J. A. M. A.* 143: 329-336 (1950).
- (7) Mackle, W., and Gregorius, F.: Cancer of the respiratory system in the United States. *Pub. Health Rep.* 63: 1114-1127 (1948).
- (8) Rostoski, O., Saupe, E., and Schmorl, G.: Die Bergkronkheit der Erzbergleute in Schneeberg in Sachsen ("Schneeberger Lungenbrebs"). *Ztschr. f. Krebsforsch* 23: 360-684 (1926).



Traveling Sanitation Classes

HAWAII. Usually students have to travel to the classroom, but in the school for food service personnel conducted by the division of sanitation, Territorial Department of Health, the classroom is brought to the students.

A sanitation education representative packs up his demonstration materials and conducts the course in a restaurant if it has more than five employees. Time for class is arranged for the employees' convenience to assure attendance, but managers or owners are required to be present also. Other classes are held in neighborhood restaurants for those places employing less than five food handlers.

Each restaurant receives an official inspection sheet and a printed form for posting on a bulletin board. Any employee discovering an insanitary condition inserts the nature of

the defect, recommendation for correction, his name, and date on the form. If the personnel and management are alert, and the sanitarian fails to find any defective conditions on his next inspection, the proprietor and employees win the game. Through the school and its encouragement of self-inspection, food service employees have become more conscientious about their work and are eager to seek advice, information, and suggestions.

Mercurial Diuretic Service

SHELBY COUNTY, TENN. The Memphis-Shelby County Health Department has proved the value of a nursing service for injecting mercurial diuretics into cardiac patients in their own homes. The program also affords opportunity for education in cardiovascular disease. It is planned to conserve the patient's energy and result in less frequent hospitalization and less crowded clinics.

At the present time, 65 percent of the nursing load is carried by district public health nurses. Registered practical nurses visit patients

in areas where a heavy concentration of cases makes it difficult for the district nurse to assume this emergency-type service.

Each cardiac patient is carefully evaluated at an out-patient clinic prior to referral to the nursing staff. Specific written instructions on medication accompany the referral. The majority of patients receive the injections weekly although treatment intervals may vary from daily to monthly. Patients return to the clinic for reevaluation whenever necessary.

The service was initiated in March 1950 by request of the Medical College of the University of Tennessee and the John Gaston teaching hospital. A brief preliminary institute on cardiovascular diseases was held by the medical staff of the college for the health department nurses. In the early experimental phase of the project, specialized nursing service was used with the idea of gradual absorption into the general program.

By May 1952, almost 800 patients were receiving the service, and more than 22,000 home visits had been made. Under supervision, the practical nurses have handled the service well.